Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz	GN Docket No. 17-183

COMMENTS OF HEWLETT PACKARD ENTERPRISE COMPANY

Chuck Lukaszewski
Vice President, Wireless Strategy
Hewlett Packard Enterprise Company
3333 Scott Boulevard
Santa Clara, CA 95054

October 2, 2017

TABLE OF CONTENTS

INTRODUCTION AND SUMMARY

Hewlett Packard Enterprise ("HPE") commends the Federal Communications Commission ("FCC" or "Commission") for its forward-looking Mid-Band Spectrum Notice of Inquiry ("NOI").[1] As one of the world's largest providers of managed wireless local area network ("WLAN") infrastructure with a global leadership position in the Wi-Fi equipment marketplace, HPE is on the front lines of an unlicensed spectrum crisis that the NOI can address.

Our Aruba business unit ships millions of Wi-Fi access points every year, representing more than 17 percent of the global enterprise and service provider market for these devices.[2] HPE's equipment is mission critical to a wide range of industries, including the largest educational institutions, hospitality enterprises, hospitals, stadiums, airports, and convention centers—as well as military and defense agencies, and other government agencies at the national, state, and local levels. HPE also serves mobile operators around the world as they expand and deepen their networks, providing not only unlicensed access points, but also servers, storage, software, and services that help power some of the planet's largest cellular core networks.

From this vantage point, HPE has gained deep insight into unlicensed technology growth and use trends, and into associated spectrum needs. What we see today is that Wi-Fi—now the single most important wireless technology in the world and carrying more internet traffic to

---

1 *Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, Notice of Inquiry, 32 FCC Rcd. 6373, ¶ 37 (2017).

2 International Data Corporation (IDC), *Worldwide Quarterly WLAN Tracker* (Sept. 2017), https://www.idc.com/getdoc.jsp?containerId=prUS43065517.

consumers than all other wireless technologies combined[3]—will soon run out of spectrum.[4] We therefore applaud the FCC for its perfect timing. The NOI has taken exactly the right approach by pairing licensed and unlicensed spectrum expansion. Moreover, it has focused on exactly the right frequency range: the mid-band.

The mid-band has become the workhorse of the wireless industry. The 5 GHz band is now home to the most innovation and investment of any unlicensed frequency range, offering attractive signal propagation properties (compared with the 57-71 GHz band) and wider channels (compared with the 2.4 GHz band).[5] Furthermore, within the mid-band, Wi-Fi is the workhorse technology. As the Commission and industry leaders have recognized, Wi-Fi is the primary technology that consumers and enterprises use to access the internet.[6]

---

[3] Cisco, *Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2016–2021* 21–22 & fig. 23, White Paper (2017) https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/mobile-white-paper-c11-520862.pdf ("*Cisco Visual Networking Index*").

[4] *See* Steve Methley & William Webb, *Wi-Fi Spectrum Needs Study* 29, Final Report, Quotient Associates, Ltd (Feb. 2017) ("*Quotient Report*"). *See also* Cisco*, Enterprise Best Practices for iOS Devices on Cisco Wireless LAN* 7, White Paper (Nov. 2016), https://www.cisco.com/c/dam/en/us/td/docs/wireless/controller/technotes/8-3/Enterprise_Best_Practices_for_Apple_Devices_on_Cisco_Wireless_LAN.pdf.

[5] *See* Aruba Networks, *Aruba 802.11ac Networks Validated Reference Design* 11 (2015), https://community.arubanetworks.com/aruba/attachments/aruba/Aruba-VRDs/61/1/Aruba%20802.11ac%20Networks%20VRD.pdf.

[6] Comm'r Michael O'Rielly, *A Mid-Band Spectrum Win in the Making*, FCC (July 10, 2017), https://www.fcc.gov/news-events/blog/2017/07/10/mid-band-spectrum-win-making ("Study after study has shown that the U.S. is going to need multiple gigahertz of licensed and unlicensed spectrum just to keep up with current growth patterns."); Comm'r Jessica Rosenworcel, *Bringing the Connected Future to All Americans, May 11, 2012–January 3, 2017*, FCC Blog (Dec. 3, 2016), https://www.fcc.gov/news-events/blog/2016/12/30/bringing-connected-future-all-americans-may-11-2012-%E2%80%93-january-3-2017 ("Moreover, as any wireless user can attest to, the airwaves used for Wi-Fi today are getting crowded—putting a premium on identifying additional spectrum for unlicensed growth."). *See also Quotient Report.*

Despite this success, the FCC has not opened any mid-band spectrum to unlicensed operations in nearly 15 years.[7] And while the millimeter bands hold great promise for wireless backhaul and other specialized wireless applications, they are simply not a substitute for the mid-band spectrum needed to address consumers' and enterprises' primary wireless needs. HPE therefore strongly supports the NOI's proposal to address both licensed and unlicensed mid-band spectrum needs together in the same proceeding. This will ensure not only that there is a reliable pipeline of spectrum for American consumers and businesses, but also that the U.S. will have a balanced spectrum policy. Supplying desperately needed spectrum resources to only licensed or unlicensed technologies, or doing so at different times, would undermine innovation, harm consumer and enterprise internet access, and put the government in the inappropriate position of choosing winners and losers.

In these comments, HPE therefore hopes to support the Commission's decision making by: (1) describing how unlicensed technologies benefit the economy, businesses, and consumers; (2) recommending that the Commission propose four new U-NII sub-bands in the 6 GHz band; (3) explaining that unlicensed operations can and will protect incumbent operations from harmful interference; and (4) urging the FCC to maintain U.S. leadership in wireless technology and policy by expeditiously issuing a Notice of Proposed Rulemaking ("NPRM") that proposes technical and service rules to govern unlicensed operations that spur investment and innovation.

[7] The FCC's important decision to permit higher powers and outdoor use of the U-NII-1 band has improved the regulation of this band, but the band was already available for unlicensed devices.

I. WI-FI IS CRITICAL TO U.S. ENTERPRISES, TRANSPORTATION, HEALTHCARE, EDUCATION, AND MILITARY PROGRAMS.

Wi-Fi and the myriad services it makes possible are deeply integrated into the lives and homes of millions of Americans. Unlicensed technologies have generated transformative innovations in consumer technology and billions of dollars of economic growth.[8] Less well understood is the impact unlicensed technologies have on the country's commercial sector, including its largest enterprises. Gone are the days when Wi-Fi systems were simply amenities supplementing core hard-wired networks. The countries' largest industries and organizations, those driving jobs, competitiveness, and growth—including manufacturing, transportation, healthcare, education, and the military—have put Wi-Fi at the center of their operations.

Wi-Fi and other unlicensed services like z-wave, Bluetooth, and RFID have become central to the entire U.S. supply chain. Advances in automation and robotics have enabled significant gains in U.S. productivity on the factory floor, where Wi-Fi plays a central role in real-time parts tracking, just-in-time parts delivery to workers by autonomous trains, and other smart manufacturing applications.[9] Products shipped by sea and land move through intermodal container terminals that depend on Wi-Fi to choreograph the movement of cranes and cargo.[10] The distribution centers, fulfillment centers and warehouses of the U.S. retail industry run almost exclusively on Wi-Fi—enabling rugged terminals on forklifts, individual workers with mobile terminals, and now robots to

---

8 *See, e.g.*, Raul Katz, *Assessment of the Future of Economic Value of Unlicensed Spectrum in the United States* 39–40 & Table 19, Telecom Advisory Services, LLC (2014), http://wififorward.org/wp-content/uploads/2017/06/Katz-Future-Value-Unlicensed-Spectrum-final-version-1.pdf.

9 *See, e.g.*, Daniela Hoffmann, *Production logistics next in line for digital overhaul*, AutomotiveIT International (Jan. 19, 2017), http://www.automotiveit.com/production-logistics-next-in-line-for-digital-overhaul/news/id-0051413.

10 *See, e.g.*, Honeywell, *Ports and Intermodal: Optimize Your Workflow Processes and Worker Performance*, https://www.honeywellaidc.com/solutions/environment/ports-and-intermodal (last visited Oct. 2, 2017).

rack, pick, pack, and ship products all while communicating with each other and the systems that coordinate their work.[11] Finally, to make sure those products get to the right address at the right time, major freight companies use fixed and mobile Wi-Fi-enabled scanning terminals.[12] And when consumers buy these products online, they almost always do so over Wi-Fi.[13] Without a robust and well-functioning Wi-Fi ecosystem, U.S. supply chain costs would increase and efficiency would plummet.

The revolution in managing complex systems using unlicensed technologies extends beyond consumer products. For example, unlicensed services have transformed the operations of the major U.S. air carriers. For consumers, wireless services, particularly in-flight Wi-Fi, are transitioning from being high-end amenities, used by relatively few travelers, to technologies relied on by a majority of travelers.[14] Significantly, unlicensed technologies also support core airline and airport operational functions. Delta, for example, has spent more than $50 million dollars deploying an RFID-based baggage tracking system—including 4,600 scanners and an RFID tag for every bag—to give passengers and baggage-handlers real time access to the status of every piece of luggage.[15] And major equipment manufacturers Airbus and Boeing have begun projects to use RFID to track

---

[11] *See, e.g.*, Jay Botelho, *Wireless in the Warehouse*, Enterprise Networking Planet (Feb. 10, 2014), http://www.enterprisenetworkingplanet.com/netsp/wireless-in-the-warehouse.html.

[12] *See, e.g.*, Jeff Berman, *New UPS scanning system boosts speed of package delivery and customer visibility*, Logistics Management (Aug. 2, 2012), http://www.logisticsmgmt.com/article/new_ups_scanning_system_boosts_speed_of_package_delivery_and_customer_visib.

[13] *See, e.g.*, *Cisco Visual Networking Index*, *supra* note 3.

[14] Bart Jansen, *Study: Airlines could generate $30B from broadband for work, shopping, entertainment by 2035*, USA Today (Sept. 26, 2017), https://www.usatoday.com/story/travel/2017/09/26/study-airlines-could-generate-30-b-broadband-work-shopping-entertainment-2035/701007001/.

[15] *Id.*

aircraft parts for operations and maintenance purposes.[16] The Federal Aviation Administration first approved Wi-Fi-enabled iPads for cockpit Electronic Flight Bags (EFBs) applications in 2011, and tens of thousands are tablets are now estimated to be in use by all major American airlines saving millions of dollars per year in fuel alone.[17] As a result of this success, airports are on the front line of the unlicensed spectrum shortage. Additional unlicensed spectrum is required to meet the performance and quality-of-service needs of both airlines and passengers.[18]

Similarly, Wi-Fi and other unlicensed technologies are now central to hospital operations. Secure, commercial-grade Wi-Fi allows clinicians and staff to move throughout the hospital with access to the large stores of data, from MRI results to prescribing databases to real-time patient vital signs, which can improve both operations and patient outcomes.[19] Innovative new medical devices, including wireless EKGs, infusion machines, and blood pressure cuffs, also take advantage of the pervasive connectivity throughout the hospital to ease monitoring and improve data reporting.[20] As a result, patients see improved quality of care and increasingly transparent access to their own health information.

---

16 *See, e.g.*, IATA, *Guidance on Introducing Radio Frequency Identification (RFID) Into Airline Maintenance Operations International Air Transport Association Safety, Operations and Infrastructure*, White Paper (May 2013), http://www.iata.org/whatwedo/ops-infra/Documents/rfid-guidelines.pdf.

17 *See* Matthew Panzarino, *American Airlines first to get FAA approval to use iPads in 'all phases' of flight, saving some $1.2M*, The Next Web (Sept. 10, 2012), https://thenextweb.com/apple/2012/09/11/american-airlines-first-get-faa-approval-use-ipads-all-phases-flight-saving-1-2m/#.tnw_htDmHiBl.

18 National Academy of Sciences Airport Cooperative Research Program, *A Guidebook for Mitigating Disruptive Wi-Fi Interference at Airports*, Report 127 (2015).

19 Chris Downey, *Mobility via Wi-Fi®: Transforming healthcare for all*, The Beacon (Sept. 16, 2014), https://www.wi-fi.org/beacon/chris-downey/mobility-via-wi-fi-transforming-healthcare-for-all.

20 *Id.*

Wi-Fi is also changing how educational institutions teach and interact with their students. Virtually all college students now arrive on campus with multiple Wi-Fi-dependent devices.[21] Students report that their mobile devices make learning more enjoyable and efficient.[22] But keeping students and faculty connected requires a sustained and significant commitment by university administrators to maintain robust Wi-Fi networks,[23] because wired and LTE connections are impractical or uneconomical in many campus environments. Libraries and K-12 educators' e-rate investments also now largely depend on Wi-Fi to successfully expand broadband access.[24] With effective Wi-Fi networks in place, teachers can use browser-based and mobile applications to interact with their students for a variety of purposes, from formal instruction to campus practicalities to emergency communications.[25] As these capabilities expand, so will the education sector's demand for additional unlicensed spectrum.

The military has long recognized Wi-Fi's benefits for managing complex, dynamic environments. Thanks to National Security Agency's Commercial Solutions for Classified ("CSfC") military-grade encryption, gigabit Wi-Fi is now being fielded by the Army to help mobilize its command posts through the Warfighter Information Network-Tactical ("WIN-T") program,

---

21 Pearson, *Pearson Student Mobile Device Survey 2015*, National Report: College Students (June 2015), http://www.pearsoned.com/wp-content/uploads/2015-Pearson-Student-Mobile-Device-Survey-College.pdf.

22 *Id.*

23 *See* Megan O'Neill, *Explosion of Wireless Devices Strains Campus Networks*, The Chronicle of Higher Education (Oct. 14, 2013), http://www.chronicle.com/article/Explosion-of-Wireless-Devices/142277.

24 *See Modernizing the E-Rate Program for Sch. & Libraries*, 29 FCC Rcd. 8870, ¶¶ 29,30 (2014).

25 *See* Aruba Networks, *Solution Overview: Higher Education*, http://www.arubanetworks.com/assets/so/SO_MobileEngagementHigherEd.pdf (last visited Oct. 2, 2017); Sherrie Negrea, *Apps move up on campus*, University Business (June 20, 2014), https://www.universitybusiness.com/article/apps-move-campus.

increasing force agility in forward deployments.[26] The Air Force has deployed secure Wi-Fi on the flight lines of all of its more than 100 bases worldwide for nearly a decade to speed access to technical orders and maintenance records,[27] while the Marine Corps is deploying secure Wi-Fi in aviation hangars to improve aircraft readiness.[28] Finally, our deployed servicemen and women depend on Wi-Fi provided through morale, welfare, and recreation ("MWR") programs of every service branch to stay connected to family and loved ones.[29]

These examples share a common theme: Wi-Fi is now mission-critical for organizations that employ, serve, and care for millions of Americans. All of these services depend on ample unlicensed spectrum. They are growing, and the supply of new unlicensed bands must grow with them.

II. THE COMMISSION SHOULD PERMIT UNLICENSED OPERATIONS IN FOUR NEW U-NII BANDS.

The Commission should continue its strategy of pursuing a balanced spectrum policy by designating the 3.7-4.2 GHz range for licensed operations and authorizing unlicensed broadband operations, including Wi-Fi, in the 5.925-7.125 GHz range ("the 6 GHz band"). Providing a pipeline for both licensed and unlicensed spectrum will allow HPE and other equipment manufacturers to provide consumers, network operators, and enterprises with the next generation of 5G wireless networks that harness the complementary advantages of LTE and Wi-Fi.

---

[26] Sean Lyngaas, *Wi-Fi for soldiers almost a reality*, FCW: The Business of Federal Technology (Mar. 23, 2016), https://fcw.com/articles/2016/03/23/wifi-army-lyngaas.aspx.

[27] Aruba, *United States Air Force Worldwide Network Takes to the Air*, Case Study (2013), http://www.arubanetworks.com/assets/cs/CS_cits.pdf.

[28] Mathuel Browne, *Pilot program tests Wi-Fi in air hangars to improve aircraft readiness*, The United States Marine Corps (Apr. 24, 2017), http://www.marcorsyscom.marines.mil/News/News-Article-Display/Article/1160526/pilot-program-tests-wi-fi-in-air-hangars-to-improve-aircraft-readiness/.

[29] ViaSat, *Navy Exchange Service Command Expands Relationship with ViaSat for Managed Wi-Fi Internet and Voice Services at Navy Facilities Worldwide* (June 8, 2015), https://www.viasat.com/news/navy-exchange-service-command-expands-relationship-viasat-managed-wi-fi-internet-and-voice.

The 6 GHz band is best suited for unlicensed operations because of its proximity to existing 5 GHz unlicensed bands, and because of Part 15 devices' unique ability to successfully coexist with the band's incumbent licensees. As discussed above, the 5 GHz band has become the center of the consumer, service provider, and enterprise Wi-Fi experience. Adding the 6 GHz band just above today's 5 GHz bands will allow HPE and other manufacturers to achieve radio, antenna, filter, and equipment design efficiencies that would be impossible even if a similar amount of spectrum were made available in a different frequency range (which appears unlikely for the foreseeable future). Furthermore, the Institute of Electrical and Electronics Engineers ("IEEE") and other industry-led standards bodies are already moving to expand the next generation of Wi-Fi standards to the 6 GHz band in anticipation of regulatory action, which will drive investment and bring devices to Americans more quickly.[30]

Conversely, clearing any part of the band of incumbents and auctioning the spectrum, or auctioning geographic "underlay" licenses, would be more complex, less efficient, and take far more time when industry can least afford delay. As the recent Incentive Auction demonstrated, the process of displacing existing licensees from a band is extraordinarily complex, and doing so in the 6 GHz band to make a new licensed service possible would be no different. An underlay auction where bidders seek geographic licensees that surround, but do not interfere with, commercial licensees is untested and almost certainly unrealistic given the particular characteristics of the incumbents in the 6 GHz band. Moreover, even if an underlay auction were possible, it would yield a service that would be a far more inefficient user of the spectrum than unlicensed operations.

---

[30] IEEE's 802.11ax Task Group has voted to expand the applicability of this standard to the 6 GHz band. IEEE, *P802.11ax PAR Modification,* Abstract (July 12, 2017), https://mentor.ieee.org/802.11/dcn/17/11-17-0913-02-00ax-par-modification-to-support-6-ghz-band.docx. Furthermore, in Europe, ETSI has begun a "System Reference Document" on unlicensed use of this band. Finally, 3GPP has initiated work on "5G NR SS" which will optimize 5G for spectrum shared by unlicensed and LTE operations.

Consequently, HPE strongly recommends that the Commission follow the easier and more productive path that most of the wireless industry supports—amending the Part 15 rules already applicable to the 6 GHz band to enable the higher-power unlicensed operation that broadband services require. Specifically, HPE recommends that the NPRM propose four new U-NII bands:

- *U-NII-5*: 5.925 GHz to 6.425 GHz—sharing with Fixed Service ("FS") and Fixed Satellite Service ("FSS") incumbents;
- *U-NII-6*: 6.425 GHz to 6.525 GHz—sharing with Broadcast Auxiliary Service ("BAS") and Cable Television Relay Service ("CARS") incumbents;
- *U-NII-7*: 6.525 GHz to 6.875 GHz—also sharing with FS and FSS incumbents; and
- *U-NII-8*: 6.875 GHz to 7.125 GHz—also sharing with BAS and CARS incumbents.

By creating four U-NII sub-bands, the Commission can adopt sharing rules that are appropriate to the incumbent distribution across these bands. For example, in U-NII-5 and U-NII-7, protecting geographically concentrated FS services may require a simplified database solution for outdoor operations. These two sub-bands have much in common, but because there are many more fixed links in U-NII-5 than in U-NII-7, somewhat different rules may be appropriate for each. The environment in U-NII-6 and U-NII-8 is far different, where the mobile and often temporary operations of BAS and CARS systems call for different sharing solutions. These two sub-bands share a mobile designation, but they may also require distinct rules. While UNII-6 is a purely mobile band with no FS at all, UNII-8 has significant Part 101 deployments.

There are other important incumbents in each of these bands, but those listed above will, in HPE's opinion, drive the Commission's interference analysis, and mechanisms adopted to protect these incumbents will also protect other classes of licensed users. As discussed more fully in Section III, below, these rules should operate in the context of the Commission's well-tested Part 15

regulatory framework, and ensure that unlicensed devices do not cause harmful interference to the particular incumbents in each sub-band, without over-regulating and undermining investment.

By identifying these four new sub-bands in the NPRM, the FCC can seek evidence on the record for customized interference protections that will ensure the incumbent licensees in each sub-band are protected, but still permit commercially feasible unlicensed deployments. For example, the Commission may determine that outdoor unlicensed operations in U-NII-5, U-NII-6, and U-NII-7 must either reduce power or adopt particular elevation-angle restrictions to protect incumbent FSS uplinks, as the FCC concluded is needed in U-NII-1.[31] There is no reason, however, to over-regulate by requiring elevation-angle restrictions in U-NII-8 where there is little FSS use.

III. UNLICENSED TECHNOLOGIES CAN SAFELY COEXIST WITH 6 GHZ BAND INCUMBENTS.

As discussed above, the Commission's rules governing unlicensed devices, combined with sharing techniques customized to each sub-band, can protect 6 GHz band incumbents from harmful interference. In fact, unlicensed devices share bands today without interfering better than any other technology. Wi-Fi has twenty years of proven experience, turning underutilized bands with incumbent-protection challenges, such as U-NII-1, U-NII-2A, and U-NII-2C, into productive forces for the U.S. economy.

Wi-Fi technologies can do this because they operate under Part 15 of the Commission's rules. Part 15 requires that unlicensed devices not cause harmful interference to licensed operations, and accept harmful interference from licensed operations.[32] Consequently, if the Commission permits unlicensed operations in the 6 GHz band, Wi-Fi not only must protect existing incumbent

---

[31] *Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, First Report and Order, 29 FCC Rcd. 4127 ¶ 37 (2014); 47 C.F.R. § 15.407(a)(1)(i).

[32] 47 C.F.R. § 15.5(b).

operations, but also must protect future or changed incumbent operations. This would not be the case for a new licensed service in the band, which, even if the FCC decided to require it to protect existing operations (substantially undermining the value of a traditional mobile wireless license), would be able to assert that incumbent licensees hoping to expand or change their facilities must ensure that they do not cause harmful interference to the new licensed service.

Furthermore, Wi-Fi is flexible enough to permit incorporation of specific co-existence mechanisms on top of the Part 15 rules that the Commission deems necessary to protect particular classes of licensees. For example, the FCC has adopted Effective Isotropic Radiated Power ("EIRP") limits,[33] antenna-pointing limits,[34] restrictions on outdoor operation,[35] antenna-height limits,[36] a requirement to transmit identifying information,[37] and even database requirements[38] in other bands to address the particular potential interference environment based on incumbent operations. Wi-Fi technologies can adapt to operate under such rules more effectively than any other wireless technology, as long as the FCC does not over-regulate and adopt rules that allow power levels that are too low for commercially reasonable uses, or sharing rules so burdensome that they make devices technically unviable.

IV. THE COMMISSION MUST ACT NOW TO MAINTAIN U.S. LEADERSHIP.

The United States, building on forward-thinking, engineering-based decisions by the FCC, has always been the global leader in wireless technology and spectrum policy. Most relevant to this

---

[33] 47 C.F.R. § 15.407(a)(3).

[34] 47 C.F.R. § 15.407(a)(1)(i).

[35] 47 C.F.R. § 15.407(a)(1) (creating different rules for indoor and outdoor operation).

[36] 47 C.F.R. §§ 96.43(a), 15.709(g)(1).

[37] 47 C.F.R. § 15.711(g).

[38] 47 C.F.R. § 96.13(c).

band, it was good Commission decision making that made Wi-Fi possible for U.S. consumers before consumers in any other country, and that launched an entire industry—with an installed base of devices that now outnumbers the entire human population.[39] This decision, and the Commission's commitment to a balanced spectrum policy in the subsequent years, had an enormous impact around the world. Other governments followed the FCC's lead, adopting their own rules permitting unlicensed operations, and in many cases adopting U.S. band plans and specific rules for protecting incumbent users. Furthermore, the FCC's decisions empowered an industry-led technical process that built (and continues to build) on Commission rules to establish standards that not only ensure device interoperability, but that also lead other nations to adopt policies similar to those in the U.S., advancing international economies of scale for U.S. businesses.

As a global company, HPE urges the Commission to continue its leadership role as we face a growing unlicensed spectrum crisis. By opening the 6 GHz band to Wi-Fi through improved Part 15 rules, the FCC will ensure that the U.S. has a pro-investment, efficiency-enhancing approach to the band that can serve as a model. Industry needs swift action on 6 GHz because a timely decision will provide certainty to support IEEE and 3GPP standards development tracks. 802.11ax and Release 15 are both "in flight" and consumers and enterprises will see better Wi-Fi products with better performance more rapidly if the FCC acts soon. If the FCC issues a mid-band order before the end of 2018, this could yield 802.11ax products in the band in 2019. HPE is committed to building and shipping products that operate in this band at the earliest possible date following a final Report & Order.

Acting in the near term is particularly important to support industry's 5G vision. 5G, more than any previous generation of wireless technology, depends on heterogeneous networks that *must*

---

[39] The Economist, *A brief history of Wi-Fi* (June 10, 2004), http://www.economist.com/node/2724397.

include both licensed and unlicensed technologies working together. If either licensed or unlicensed technologies lack the spectrum resources needed for growth, then the assumptions undergirding 5G will fail. Bandwidth needs continue to grow exponentially, so we need to act now. The alternative is increased congestion and degraded consumer experiences, especially in high-density locations.

CONCLUSION

Wi-Fi has become the wireless technology of choice for consumers and businesses across the country. As cloud computing, machine-to-machine communications, and 5G advance, the nation's reliance on Wi-Fi will continue to grow. However, consumer and enterprise demand has outpaced the government's identification of new unlicensed bands. We will soon run out of unlicensed spectrum.

HPE therefore strongly supports the Commission's decision to pursue additional licensed and unlicensed spectrum through the NOI. Specifically, we recommend that the FCC:

- Expeditiously issue a NPRM proposing to open the entire 6 GHz band to Wi-Fi;
- Propose to establish four new sub-bands (U-NII-5, U-NII-6, U-NII-7, and U-NII-8) with interference-protection mechanisms customized to the incumbent operations found in those frequency ranges; and
- Seek comment on the particular operating rules and sharing approaches that will protect licensees from harmful interference while still allowing the commercially viable Wi-Fi investments that the country needs.

Taking these steps will maintain U.S. wireless leadership, keep the industry-led standardization process on track to make technology available to consumers and enterprises in the near term, and address our looming spectrum crisis.

Respectfully submitted,

Chuck Lukaszewski
Vice President, Wireless Strategy
Hewlett Packard Enterprise Company
3333 Scott Boulevard
Santa Clara, CA 95054

October 2, 2017